Policy Implications of a Behavioural Economics Analysis of Land Use Determinants in Rural Scotland

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ABSTRACT

The paper analyses the land use behaviour of Scottish land managers and the factors influencing it in the current context of the EU rural land use policies. The analysis employs a frequently used behavioural economics method, namely structural equation modelling (SEM). Central to the empirical analysis in this paper is a cross-section database containing data collected in May to June 2009 through telephone interviews of 600 land managers in Scotland. The model tests and estimates the relationships between land use behaviour, *i.e.*, behavioural intentions to change the size of business/holding, and several of its *a priori* determinants found significant in the scientific literature. The results indicate that a stronger propensity to change size of their businesses is exhibited by younger land managers who intend to pass their land on to family, with larger land size and stronger attitudes towards increasing it, with lower percentage of their income made up from Government support, who are less likely to have perceived changes in regulation and input/output prices as having an impact on their business, who discuss and plan changes in size of business with their banks/building societies, and frequently access sources of information to help with their strategic decisions.

Keywords

Land use, rural policies, Scotland, structural equation modelling.

1. INTRODUCTION

Current developments in the rural land use policies in the European Union (EU) take into consideration a complex set of challenges, which include climate change and increasing environmental stress, food security and the need to ensure sustainable rural communities. Furthermore, in the current context where agricultural support is divorced from production through the single payment scheme, rural land use decision-making is expected to be increasingly influenced not only by economic factors, but also by environmental, social and cultural ones. Thus, the aim of this paper is to analyse the land use behaviour of Scottish land managers and the factors influencing it in the current context of the EU rural land use policies. The paper is organised as follows: section 2 briefly reviews the literature on determinants of land use change behaviour; section 3 describes the survey data and the methodology (structural equation modelling); section 4 discusses the results and section 5 presents some conclusions.

2. DETERMINANTS OF CHANGES IN LAND USE BEHAVIOUR

This section briefly presents the literature on the factors influencing business growth and land managers' decision making as regards changes in business size, focusing on the determinants analysed in this paper.

There are several factors that may have some influence on the decision-making process of land managers on land use issues, such as changing the size of business/holding. Amongst the factors potentially influencing land use are socio-demographic variables (such as age, education, gender, land inheritance and succession, *etc*.), economic variables (such as land size, income), access to information about/advice on land use issues, attitudes towards land use/size change, land management behavioural intentions, *etc*. There is a large body of research analysing the aforementioned determinants of land use behaviour of land managers (*e.g*., Wilson, 1992; Pouta and Rekola, 2001; Young *et al*., 1995). Tweeten (1984), Goddard *et al*. (1993), and Hallam (1993) provide comprehensive reviews of the literature in this area. Issues such as intentions to leave the business to children are determinants of behaviour as regards changes in business size (Gasson and Errington, 1993). The importance of succession to business development was established in the 1980s (Calus *et al*., 2008). Weiss (1999) noted that succession has a positive effect on the incentive to undertake long-run investments, ensuring a higher rate of business growth. This corroborates the findings of Upton and Haworth (1987), namely that family members provide both an incentive and labour resources for expansion. Goddard *et al*. (1993) and Zepeda (1995) include changes in relative prices and public programs amongst the factors causing change in business structure. Attitudes to policy changes have been analysed in a number of studies (Gorton *et al*., 2008). Gorton et al. (2008) state that while attitudes' impact on behaviour has been extensively analysed (Bagozzi, 1981), there have been fewer attempts to study the relationship between attitudes and behavioural intentions (Bergevoet *et al*., 2004, Burton, 2004; Edwards-Jones, 2006).

3. DATA AND METHODOLOGY

Central to the empirical analysis in this paper is a cross-section database containing data collected in May to June 2009 through telephone interviews of 600 land managers in Scotland. The database includes data on socio-demographic and economic information about land managers and their businesses, frequency of access to information sources, attitudes, perceptions and knowledge of land use policies and markets, attitudes, priorities for running the business, intentional investment behaviour, and intentions to change business size.

Based on a review of the literature on the *a priori* determinants of land use behaviour we selected some of these main factors and tested their influence on land managers' decision-making using a structural equation modelling (SEM) approach. SEM approach has been frequently used for studying land use decision-making (see Bayard and Jolly, 2007; Dyer *et al*., 2007; Karppinen, 2005; Toma and Mathijs, 2007). SEM is a statistical

technique for testing and estimating relationships amongst variables (often placing the interest in the relationships between latent variables of attitude and behaviour and/or behavioural propensity regarding specific issues – see Ajzen and Fishbein, 1980), using a combination of statistical data and qualitative causal assumptions. While the idea of causality may be controversial (Mueller, 1996), SEM is not intended to discover causes but to assess the soundness of the causal relationships researchers formulate.

SEM consists of two parts, namely the measurement model specifying the relationships between the latent variables and their constituent indicators, and the structural equation model designating the causal relationships between the latent variables. The model is defined by the following three equations in matrix terms (Jöreskog and Sörbom, 2001):

The structural equation model: $\eta = B\eta + \Gamma\xi + \zeta$

The measurement model for y: $y = \Lambda_y \eta + \varepsilon$

The measurement model for x: $x = \Lambda_x \xi + \delta$

Where: η is an mx1 random vector of endogenous latent variables; ξ is an nx1 random vector of exogenous latent variables; B is an mxm matrix of coefficients of the η variables in the structural model; Γ is an mxn matrix of coefficients of the ξ variables in the structural model; ζ is an mx1 vector of equation errors (random disturbances) in the structural model; y is a px1 vector of endogenous variables; x is a qx1 vector of predictors or exogenous variables; Λ_y is a pxm matrix of coefficients of the regression of y on η; Λ_x is a qxn matrix of coefficients of the regression of x on ξ ; ε is a px1 vector of measurement errors in y; δ is a qx1 vector of measurement errors in x.

SEM takes into account both direct and indirect causal relations between constructs, which means that one causal relation may be reinforced or counteracted by another.

We undertake SEM with categorical variables, some of which dichotomous, some others defined on ordinal scales (Likert scale) using the statistical package Lisrel 8.50 (Jöreskog and Sörbom, 2001). The model is estimated by normal-theory maximum likelihood (MLE) method (Bollen, 1989), which is consistent with the sample size (n=600).

We built a structural equation model with observed and latent variables to test and estimate the relationships between land use behaviour, *i.e.*, behavioural intentions to change the size of business/holding, and several of its *a priori* determinants found significant in the scientific literature (*e.g.*, socio-demographic, economic and attitudinal variables).

The model includes three observed variables and six latent variables. The observed variables are: socio-demographic (age) and economic variables (land size; income made up from Government support). Three of the latent variables are attitudinal/perception variables, namely: perceived effect on way of managing business/holding during the past ten years from changes in input prices, changes in output prices and changes in regulation; perceived influence on decision to change or not the size of the business/holding (discussion with bank/building society manager) and attitudes towards increasing the size of business/holding. Two of the latent variables are intentional behaviour variables, namely intention to pass on the business; and intention to change the size of business. And one latent variable was constructed based on stated frequency of

access to information sources to help with strategic decisions, namely taking a consultant's advice; attending open days or demonstration activities; and meeting with other land managers. Table 1 presents descriptive statistics for the indicators used to build the latent variables.

Table 1. Descriptive statistics

Latent variables	Indicators	Mean	Std. Deviation
land	Land owned (totland)	4.33	1.833
age	Age (ages)	2.77	.835
passon	Intention to pass the business/holding on to another family member or business partner, associate (passons)	.65	.479
funds	Percentage of the income from business/holding made up from Government support (support)	1.69	.794
effect	Perceived effect on way of managing business/holding during the past ten years from: changes in input prices (effecta)	2.36	.740
	Perceived effect on way of managing business/holding during the past ten years from: changes in output (products, services) prices (effectb)	2.32	.747
	Perceived effect on way of managing business/holding during the past ten years from: changes in regulation (effectc)	2.25	.763
info	Frequency of taking a consultant's advice to get ideas on strategic decisions (medium & long term development of the business/holding) (infoa)	2.07	.856
	Frequency of attending open days or demonstration activities to get ideas on strategic decisions (medium & long term development of the business/holding) (infob)	2.11	.767
	Frequency of meeting with other land managers to get ideas on strategic decisions (medium & long term development of the business/holding) (infoc)	2.12	.889
sizinfl	Perceived influence on decision to change size of business/holding or activities from: bank/building society manager (sizinflb)	1.74	.795
attsize	Increasing the size of one's business/holding is the right way to go (attsizes)	3.17	1.151
chnsize	Intention to change size of business/holding in the next 5-10 years (chnsizes)	4.29	.763

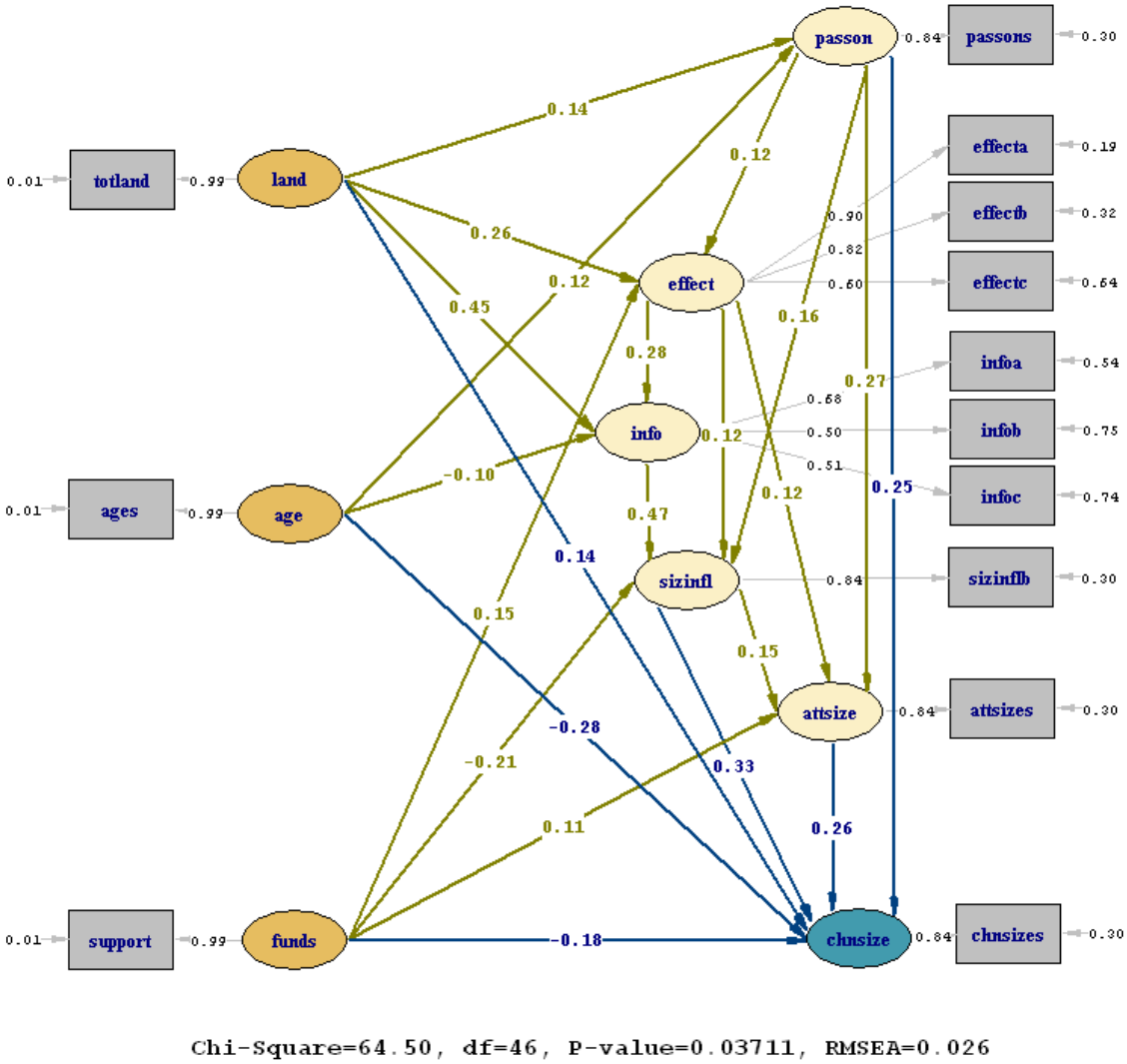
All indicators are categorical variables, with one of them dichotomous (‘passons’), while the others being defined on a Likert scale. As regards the latent variables, two of them have three indicators (‘effect’ and ‘info’) and four are single-indicator variables (‘passon’, ‘sizinfl’, ‘attsize’, ‘chnsize’) (Hair *et al*., 2006). As a test of the validity of the

multiple-indicator latent variables we undertook factor analysis with varimax rotation. The total variance of the indicators explained by 'effect' and 'info' was 66 and respectively 56 percent, and Cronbach's Alpha values were .735 and respectively .607. When running factor analysis for all the variables, each loaded significantly on different factors close to or above the threshold.

4. RESULTS AND DISCUSSION

Based on the existing literature it was reasonable to assume a certain amount of underlying causality amongst the variables in the model. Hence we tested the model described in Figure 1, which presents the path diagram for the estimated model.

Figure 1. Path diagram for the estimated model (standardised solution)



The estimated model includes three ***exogenous*** *variables*, namely 'land' (land size), 'age' (age), and 'funds' (income made up from Government support). 'Passon' (intention to pass on the business), 'effect' (perceived effect on way of managing business/holding), 'info' (frequency of access to information sources to help with strategic decisions), 'sizinfl' (perceived influence on decision to change size of business/holding or activities from: bank/building society manager) and 'attsize' (attitudes towards increasing size of business) are *variables* with ***alternating roles***, namely ***endogenous*** in some equations ('passon' predicted by 'land' and 'age'; 'effect' predicted by 'land', 'passon' and 'funds'; 'info' predicted by 'age', 'land', 'effect'; 'sizinfl' predicted by 'effect', 'passon', 'info', 'funds'; 'attsize' predicted by 'effect', 'passon', 'sizinfl', 'funds') and ***exogenous*** in other equations (passon' predicting 'effect', 'sizinfl', 'attsize' and 'chnsize'; 'effect' predicting 'info', 'sizinfl', 'attsize'; 'info' predicting 'sizinfl'; 'sizinfl' predicting 'attsize' and 'chnsize'; and 'attsize' predicting 'chnsize'). The behavioural variable, 'chnsize' is ***endogenous*** as predicted directly or indirectly by all the other variables.

The model has a very good fit according to the measures of absolute, incremental and parsimonious fit (Hair *et al*., 2006) (Table 2). Namely, it exhibits low chi-square value; normed chi-square (ratio between the chi-square and number of degrees of freedom) value is within the recommended interval of 1 to 3; root mean square error of approximation (RMSEA) value is safely below the threshold maximum value of 0.10; standardised root mean residual (SRMR) value is lower than the threshold of 0.08; normed fit index (NFI), non-normed fit index (NNFI), comparative fit index (CFI), incremental fit index (IFI), relative fit index (RFI), goodness of fit index (GFI), adjusted goodness of fit index (AGFI) values are all above the cut-off values for fit indices, the 'magic 0.90 or 0.95' (Hair *et al*., 2006). Values of the Hoelter's critical N (largest sample size at which the model is accepted at the .05) is above sample size. The main goodness of fit (GoF) indicators are presented in Table 2.

GoF indicators	Great Britain
Degrees of Freedom	46
Normal Theory Weighted Least Squares Chi-Square	64.50 (P = 0.037)
Root Mean Square Error of Approx. (RMSEA)	0.026
P-Value Test Close Fit (RMSEA<0.05)	1.00
Normed Fit Index (NFI)	0.96
Non-Normed Fit Index (NNFI)	0.98
Comparative Fit Index (CFI)	0.99
Incremental Fit Index (IFI)	0.99
Relative Fit Index (RFI)	0.94
Critical N (CN)	666.34
Standardized RMR	0.025
Goodness of Fit Index (GFI)	0.98
Adjusted Goodness of Fit Index (AGFI)	0.97

Additional testing of the appropriateness of the model was achieved by comparing the estimated model with two other models using a nested model approach. The results across all types of goodness-of-fit measures favoured the estimated model in all cases.

An acceptable level of overall goodness-of-fit does not guarantee that all constructs meet the requirements for the measurement and structural models. The validity of the SEM is assessed in a two-step procedure, the measurement model and the structural model.

The measurement model results show that the sets of indicators for the multiple-indicator constructs have comparable indicators with all loadings statistically significant. We tested the reliability of the single-indicator latent variables, namely we tested the 'theory-testing extremes' of reliability within the range of 0.7 to 1 (Ping, 2008) and determined that none of the structural coefficients became non-significant at these extremes. The reliability of the single-indicator latent variables was assumed the value of 0.99 for the observed variables (built in the model as single-indicator latent variables), namely 'age', 'land' and 'funds' with the corresponding loadings (square root of reliability value) of 'age', 'land' and 'funds' on 'ages', 'totland' and 'support' of 0.99 and the standardised measurement error variance of 0.01; and value of 0.7 for 'passon', 'sizinfl', 'attsize' and 'chnsize' with the corresponding loadings of 0.84 and the standardised measurement error variance of 0.3.

After assessing the overall model and aspects of the measurement model, the standardised structural coefficients for both practical and theoretical implications were examined. The significance tests for the structural model parameters represent the basis for accepting or rejecting the proposed relationships between exogenous and endogenous constructs. Table 3 shows that all variables have statistically significant coefficients (total effects on 'chnsize'). Table 3 presents the standardised total, direct and indirect effects on the behavioural latent variable of all the other latent variables in the model.

Table 3. Standardised total, direct and indirect effects on behavioural latent variable (t-values in parentheses)

Observed/ latent variables	Direct effect	Indirect effect	Total effect
	Intention to change size of business/holding in the next 5-10 years (chnsize)		
land	0.12 (2.86)	0.14 (5.79)	0.26 (6.16)
age	- 0.24 (-6.61)	0.03 (1.45)	-0.21 (-5.56)
funds	- 0.15 (-3.68)	-0.02 (-1.15)	-0.17 (-4.20)
passon	0.25 (4.47)	0.14 (4.72)	0.39 (7.19)
effect	0.0	0.10 (4.44)	0.10 (4.44)
info	0.0	0.14 (4.49)	0.14 (4.49)
sizinfl	0.33	0.04	0.37

	(5.95)	(2.21)	(6.58)
attsize	0.26 (4.60)	0.0	0.26 (4.60)

The model predicts 50 percent of the variance in intentional behaviour (intention to change size of business/holding in the next 5-10 years).

In terms of individual effects, all variables were found to be significant determinants of intentional behaviour as regards changes in size of business, from intention to pass the business on to another family member or business partner, perceived influence on decision to change size of business from bank/building society manager, land owned, attitudes towards increasing the size of business, age, percentage of the income from business made up from Government support, frequency of access to sources of information to get ideas on strategic decisions, to perceived effect on way of managing business during the past ten years from changes in input/output prices and regulation explaining between 39 percent to 10 percent *ceteris paribus* of the variance in intentional behaviour.

Land managers' intention to pass on the business has the strongest impact on their intentions to increase business size. This is consistent with the literature on the importance of succession to business development (Calus *et al*., 2008; Upton and Haworth, 1987) and means that land managers who have family/business partners likely to continue in business are more likely to increase size of business. The other main determinant of intentional behaviour is the perceived influence on decision to change size of business from bank/building society manager. The high impact of this variable shows the important role that finance plays, namely that intention to develop business depends on having discussed it with the bank. Most of all, land managers with stronger attitudes towards increasing business have stronger intentions to develop business and this is again consistent with the literature on the relationship between attitudes and behaviours (Ajzen and Fishbein, 1980). Socio-economic factors (age, land size, income) and access to relevant information were also found to significantly influence behaviour, which again confirm findings from the scientific literature. A lower but still significant impact on behaviour is past experience, namely perceived effects on business of market changes (prices and regulations) in the past.

5. CONCLUSIONS

The paper analysed the land use behaviour of Scottish land managers and the factors influencing it. The results are consistent with findings from the literature and indicate that the significant direct determinants of the intention to increase the size of the business are: intention to pass on the business (positive), perceived influence on decision to change size of business from bank/building society manager, age (young), land size (large), income from government support (negative), and attitudes towards changing size of business. The significant indirect influences are frequency of access to various sources of information to get ideas on strategic decisions (medium & long term development of the

business/holding) and perceived effect on way of managing business/holding during the past ten years from changes in input and output prices and regulation.

This shows that a stronger propensity to change size of their businesses is exhibited by younger land managers who intend to pass their land on to family, with larger land size and stronger attitudes towards increasing it, who are less likely to have perceived changes in regulation and input/output prices as having an impact on their business, who discuss and plan changes in size of business with their banks/building societies, and frequently access sources of information to help with their strategic decisions, with lower percentage of their income made up from Government support.

This suggests a stronger market orientation, and move away from the subsidy dependence characteristic of agriculture in particular. Some of these findings are to be expected – for example that decision-makers focused on economics are interested in increasing the overall size of their business; similarly, the importance of succession to business development was established in the 1980s (Calus *et al*., 2008). Attitudes towards increasing business size, and discussions with bank managers, have very strong influence, demonstrating the important role the banking system plays in land-based business expansion. What is also interesting is the relationship between managers' perceptions of market changes to having had an impact on business in the past ten years and their intention to expand.

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